Can a hole be inflamed?
On the handling of anatomical cavities in SNOMED CT©

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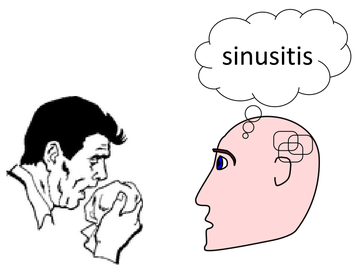
The world of human reasoning



Colloquial expressions

Hidden Knowledge:
Sinusitis means inflammation of sinus
Sinus is a cavity which is lined by a mucous membrane
Only tissues (e.g. submucous tissue) can be inflamed

Humans „just understand it right“

Representational principle: „Domain Adequacy“:
Terminology concepts shall reflect human understanding

The world of machine reasoning

precise expressions
explicit knowledge
strict logic reasoning:

Sinusitis means *Inflammation of Sinus*
and *Sinus* is a *Cavity*
and only *Tissues* can be inflamed
=> contradiction

Machines need everything right

Representational principle: „Logical Consistency“
Ontology classes are defined by logical axioms

Can SNOMED CT bridge the worlds?

Example of anatomical cavities to illustrate the steps to be taken

Current SNOMED CT definition of „maxillary sinusitis“

(using OWL-DL in Manchester Syntax)

Maxillary sinusitis equivalentTo
associated_morphology some *Inflammation* and
finding_site some *Maxillary sinus structure*

Necessary formal adjustments

SNOMED CT should clarify the ontological nature of morphologic abnormalities

Most material correlates of pathological processes can be described as altered body parts (e.g. inflamed tissue) . Alternatively one can ascribe them qualities , e.g. tissue which is inflamed. Using process nouns for describing morphology is misleading.

SNOMED CT should distinguish between localization and participation

A process (such as *Maxillary sinusitis*) has material structures as participants. Both processes and material structures are located in material or immaterial structures. These are not necessarily participants.

SNOMED CT relations should conform to a relation ontology, e.g. the OBO RO. Rules for the concatenation of relations should be established, e.g. the transitivity of **part_of** and **has_location**, or the right identity:
part_of • has_location → has_location

SNOMED CT concepts should be related to a principled top level ontology

This will define basic categories like „*Material structure*“ and „*Immaterial structure*“, and axioms such as „a *Material structure* can be **located_in** an *Immaterial structure*, but not be **part_of** an *Immaterial structure*“

The upper ontology GFO contains a precise description of cavities.
From these the following can be derived:

1. Holes have a host, they are dependent entities
2. The host is not part of the hole
3. Holes can contain a material structure
4. Their contents are not part of the hole, but the host of the hole can (but doesn't need to) have the containees as part.

Result

In SNOMED CT

the relations "has_participant" and "has_location" substitute the (ambiguous) relation has_finding_site

SNOMED CT should basically distinguish
1. *Body part*, which is a material object and is in the range of "**has_participant**"
2. *Body region*, which is a spatial region and in the range of "**has_location**"
3. *Body cavity*, which is a hole and is also in the range of "**has_location**"

Abnormal morphologies are described in terms of qualities

Body parts are related to their inherent qualities by the relation "**bearer_of**“

Allow nesting of expressions

The example then looks like this:

Maxillary sinusitis equivalentTo
Pathological process and
has_participant some (*Mucous membrane* and **bearer_of** some *Inflammatory Quality*) and
has_location some *Maxillary sinus*